

PREPARATION FOR MAJOR BURNS INCIDENTS: EVALUATION OF CONTINUING MEDICAL EDUCATION TRAINING COURSES FOR PROFESSIONALS

PRÉPARATION À LA PRISE EN CHARGE DES BRÛLÉS DANS UN CONTEXTE DE CATASTROPHE: ÉVALUATION D'UNE FORMATION DESTINÉE AUX PROFESSIONNELS

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SUMMARY. The purpose of this study was to identify changes in the competence of healthcare providers who underwent training courses on the management of burns incidents. Theoretical and practical simulation training courses were conducted for 305 healthcare providers from emergency and trauma departments of general hospitals in Vietnam. Pre- and post-tests were conducted using questionnaires and with simulated practical skill evaluation by burns specialists. Results showed a significant improvement in knowledge of emergency management of burns incidents, with an increase in percentage of correct answers from 48.2% to 71.6% ($p < .01$). There was an average increase from 10.5% to 95.1% for the correct calculation of total body surface area involvement, and from 33.8% to 67.2% for using the Parkland formula. Increases in knowledge of resuscitation and management of inhalation injury were also noted ($p < .01$). For the management of major burns incidents, sufficient knowledge of the command system increased from 58.4% to 81.9%. A better understanding was gained of the missions of the Emergency Medical Team, triage and air evacuation after training ($p < .001$). Emergency practical skills such as CPR, ET intubation, splinting of bone fractures, burn wound dressing and using emergency medical devices also improved remarkably ($p < .001$) after practical simulation training. In conclusion, these results indicate that a significant improvement in the capabilities and competence of medical staff in the emergency management of burn injuries can be achieved by conducting training courses with combined theory components and practical simulation models.

Keywords: mass burn incident, training course, knowledge, practical skills

RÉSUMÉ. Le but de cet étude était d'évaluer les changements de compétence des professionnels de santé ayant suivi une formation à la prise en charge des brûlés en situation de catastrophe. Une formation théorique et pratique (simulation) a été réalisée au profit de 305 professionnels de santé de services d'urgence et de traumatologie vietnamiens. Des questionnaires ont été remplis avant et après formation et les simulations ont été évaluées par des brûlologues. Les bonnes réponses aux questionnaires passent de 48,2 à 71,6% après formation ($p < 0,01$). L'exactitude de l'évaluation de la SB est passé de 10,5 à 95,1%, l'adéquation du remplissage (Parkland) de 33,8 à 67,2%. La prise en charge de l'inhalation de fumées a aussi été améliorée ($p < 0,01$). Pour ce qui est de la catastrophe, les connaissances sur les échelons de commandement étaient correctes dans 58,4% des cas avant, 81,9% après. De même, la compréhension du rôle de l'équipe médicale, du triage et de l'évacuation aéroportée s'est améliorée ($p < 0,001$). L'amélioration est nette aussi ($p < 0,001$) concernant les gestes d'urgences comme le massage cardiaque, l'intubation trachéale, l'immobilisation des fractures, les pansements de brûlure et l'utilisation du matériel. Cette étude montre qu'une nette amélioration des compétences des équipes dans la prise en charge en urgence des brûlés peut être améliorée au moyen d'une formation mixte théorique et pratique.

Mots-clés : brûlure, catastrophe, formation, connaissances, compétences pratiques

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Introduction

The medical management of major burns incidents is more difficult than the management of other types of trauma.

The reasons for this are unforeseen occurring accidents, a potentially large number of patients with severe cutaneous burn injuries, inhalation injuries and concomitant trauma at the same time.

Thus, there is an immediate demand for a large amount of medications, equipment and medical professionals.^{1,2,3}

In addition, it is important to note that healthcare providers who participate in the pre-hospital and/or in-patient hospital phase of mass burn injury management must have sufficient knowledge of and practical skills in emergency care, triage and transportation of these critical patients.^{4,5}

Continuing medical education (CME) is the most common model for updating knowledge, skills and competence among healthcare providers.

Theoretical and practical knowledge, as well as experience, can be improved and maintained through training in a simulated environment.^{6,7} In addition, practical simulation training is an effective method for improving the clinical skills of healthcare providers in both pre-hospital and in-patient phases of emergency management of mass casualty incidents.^{8,9,10}

Despite significant efforts, limited knowledge and practical skills in medical response to disasters involving mass burn incidents continue to be reported.^{11,12,13,14}

Similar to other developing countries, recent reports in Vietnam indicate the limited knowledge of healthcare providers as far as emergency management of mass burn injuries is concerned.^{15,16} In order to improve the situation, training courses have been conducted.

This study attempted to evaluate changes in knowledge and emergency practical skills for the management of burns incidents amongst healthcare providers who had taken part in training courses.

Materials and methods

Between August and October 2016, three training courses were conducted for 305 healthcare providers

including physicians and nurses working in emergency and trauma departments of district and provincial general hospitals in Vietnam. The educational curriculum included 8 hours of lectures in theory and 4 hours of practice on mannequins. Materials were designed by burns specialists at the National Institute of Burns. Pre- and post-tests were conducted using questionnaires and with simulated practical examination evaluated by the burns specialists.

The test contents included basic knowledge of burn extent estimation, fluid resuscitation using the Parkland formula, manifestation and emergency management of inhalation injury, and knowledge of mass burn injury management including the command system, missions of the emergency medical team (EMT), triage, appropriate methods of fluid resuscitation and air evacuation. Overall knowledge level was defined as percentage of correct answers. Simulated emergency practical techniques such as basic cardiopulmonary resuscitation (CPR), endotracheal (ET) intubation, peripheral intravenous access, splinting of bone fracture(s), burn wound dressing and the use of emergency medical devices (defibrillator, infusion pump, monitor, basic mechanical ventilator) were included in the simulation training on mannequins, and the outcomes were evaluated by burns specialists.

Data was calculated as percentage of correct answers, tabulated and analyzed. Paired t-tests of pre- and post-training courses were applied using Stata 11.0 software. P value $\leq .05$ was considered as the significant level.

Results

Of 305 healthcare providers, 155 (50.8%) worked at provincial hospitals and 174 participants were physicians, accounting for 57.1%. There was a predominance of males (n=198, 64.9%) and 51.8% (n=158) participants had less than 5 years of working experience (*Table I*).

Knowledge of emergency burns management was significantly improved after the training courses. Percentage of correct calculation of burn extent and required fluid resuscitation using the Parkland formula increased from 10.5% to 95.1%

Table I - Characteristics of participants (n=305)

Criteria	Sub-groups	Number	%
Workplace	Provincial hospital	155	50.8
	District hospital	150	49.2
Occupation	Physician	174	57.1
	Nurse	131	42.9
Gender	Male	198	64.9
	Female	107	35.1
Working experience	< 5 years	158	51.8
	5 years	147	48.2

and from 33.8% to 67.2% respectively ($p < .001$). Moreover, there was a significant gain in knowledge of evaluation of fluid resuscitation (from 14.8% to 82%; $p < .001$) and the diagnosis of inhalation injuries and emergency management (from 49.2% to 86.9%; $p < .001$) (*Table II*).

Regarding mass burn injury management, *Table III* shows that there was a significant improvement of all contents. Sufficient understanding of the command system had increased from 58.4% to 81.9%. Mission of burn EMT was also better understood after the training courses (from 90.2% to 100%; $p < .001$).

Table II - Knowledge of burn emergency management (n=305)

Contents	Pre-test		Post-test		p
	n.	%	n.	%	
Burn extent calculation	32	10.5	290	95.1	< .01
Required fluid calculation using Parkland formula	103	33.8	205	67.2	
Required urine output for fluid resuscitation	45	14.8	250	82	
Inhalation injury diagnosis and emergency management	150	49.2	265	86.9	

Table III - Knowledge of major burns incidents (n=305)

Contents	Pre-test		Post-test		p
	n.	%	n.	%	
Command system	178	58.4	250	81.9	< .001
Mission of burn EMT	275	90.2	305	100	
Mission of triage group	170	55.7	298	97.7	
Practice of triage scenarios	106	34.8	285	93.4	
Appropriate method for fluid resuscitation in mass burn injuries	165	54.1	285	93.4	
Air evacuation indication for burn patients	189	62	256	83.9	

EMT = emergency medical team

.001). In addition, increased knowledge of triage, fluid resuscitation and air evacuation was also recorded ($p < .001$).

Overall results for participant knowledge are indicated in *Table IV*. A significant change in percentage of correct answers was recorded (from 48.2% to 71.6%; $p < .01$). Participants with more than 75% correct answers had increased from 9.5% to 42.9% ($p < .001$). Meanwhile, the rate of those with less than 50% correct answers had significantly decreased, from 20% to 7.9% ($p < .001$).

The results of simulated practical skill evaluations are shown in *Table V*. Before simulation training, CPR was correctly performed by 44.9% of participants: after training this rate increased significantly to 91.8% ($p < .001$). Successful endotracheal intubation rate increased from 38% to 82% ($p < .001$). Incidence of correct splinting for bone fracture(s) increased from 47.5% to 81.3%. The same situation was also recorded for burn wound dressing and peripheral intravenous access (from 24.6% to 68.5% and from 33.6% to 60.3% respectively, $p < .001$).

.001). Correctly using emergency medical devices (defibrillator, monitor, infusion pumps and mechanical ventilator) also improved (from 33.8% to 64.9%, $p < .001$).

Discussion

Despite extensive efforts, healthcare providers may not be adequately prepared for disasters. Most reports in the literature indicate that healthcare providers and medical supporters need further training on emergency disaster management.^{5,11,17,18} For example, a survey by Berhanu et al. showed that about 25% of participants did not understand the basic steps of “ABC” in first aid management of trauma. About a third had inadequate knowledge of the disaster response cycle. In addition, only 20.6% of the respondents had been trained in disaster-related topics in the two years prior to the survey.¹⁹ Chokshi and colleagues conducted an online survey, involving members of the American Pediatric Sur-

Table IV – Knowledge overall results (n= 305)

Percentage of correct answers	Pre-test		Post-test		P
	n.	%	n.	%	
31 - 49%	61	20	24	7.9	< .01
50 - 75%	215	70.5	150	49.2	
> 75%	29	9.5	131	42.9	
Average, %	48.2		71.6		

Table V – Results of practical skills evaluation (n= 305)

Evaluated contents	Pre-test		Post-test		P
	n.	%	n.	%	
CPR	137	44.9	280	91.8	< .01
ET intubation	116	38	250	82	
Long bone fracture splinting	145	47.5	248	81.3	
Burn wound dressing	75	24.6	209	68.5	
Peripheral intravenous access*	44	33.6	79	60.3	
Efficient use of emergency medical devices**	103	33.8	198	64.9	

CPR = cardiopulmonary resuscitation; ET = endotracheal; * = only for nurses;

** = defibrillator, infusion pumps, monitor, mechanical ventilator

gical Association, on experience, perceived preparation, responsibility attitudes, willingness and readiness to take part in a disaster response. Results indicated that 77% of respondents certainly felt responsible for helping out during a disaster but only 24% felt definitely prepared for disaster response. Moreover, most felt they needed additional training.²⁰ In 2018, Naser and Saleem conducted a survey of healthcare professionals, which indicated that only one third of the participants had sufficient knowledge of disaster planning. A total of 41% of respondents had never attended a training course. Only 13.5% had participated in triage exercises.²¹ In 2015, Hodge et al. reported from their study that nearly half of nurses (44.6%) rated themselves as unprepared for a disaster.²² Moreover, in 2018, a systematic review by Labrague and co-workers on preparedness for disasters showed that nurses were insufficiently prepared and were not confident they could respond effectively to disasters.²³

CME plays an important role in updating the knowledge and practical skills of medical staff, not only for their normal working day but also for mass casualty incidents. CME assists medical staff in understanding, being ready for and feeling confident about mass injury management procedures.²⁴ It is also noted that the development of a standardized, accessible simulation training platform system can reduce medical errors and stress levels in medical practices.^{25,26,27} Simulation is also considered to be a positive training and education method for medical staff. It provides opportunities to facilitate assessment, treatment and implementation of procedures and devices under realistic conditions.^{1,8,28} Classroom training and simulation can overcome the problem of “dead-document” phenomenon or “paper-plan syndrome”.²⁹ It is also noted that simulation learning involves theory, and practical skills can be applied and integrated with already existing skills. The simulation creates experiences and helps participants to gain a better understanding of the clinical presentation of actual disease or injury.^{9,7}

In fact, the effectiveness of such training courses has been reported worldwide. O'Brien and colleagues demonstrated an improvement in three aspects, namely disaster planning, community linkages and collaborations, and emergency re-

sponse exercises.³⁰ Works by Idrose and co-workers indicated that classroom training and simulation effectively improved knowledge of disaster planning at low cost and were relatively easy to conduct. There was a mean gain from 47.3 (18.8%) to 84.0 (18.7%) in the post-test ($p < 0.05$), and all levels of participants could be grouped together for training.³¹ Classroom training and simulation can overcome the problem of “dead-document” phenomenon or “paper-plan syndrome”.

In 2012, a report by Vincent et al. showed that the mannequin-based simulation model improved understanding of mass casualty triage among healthcare providers from Asia Pacific regions.³² In 2006, Pryor et al. evaluated the change in perceptions of responding to weapons of mass destruction events using the tabletop/real-time-exercise format. There was a consistent improvement in self-rated capabilities after course completion for all 21 capability statements.³³ Sahu & Lata also indicated multiple areas where simulation appeared to be useful for training physicians in emergency departments. The standardization of such simulation training could improve overall patient care during times of high demand, and even when the availability of senior staff is limited.³⁴

Regarding the management of burns and major burn incidents, current reports show insufficient teaching in burns management and inadequate skills of medical staff in airway management, CPR, triage, and assessing and managing burns victims.³⁵ Numerous surveys have indicated that, before training courses, many healthcare providers may not be ready or feel confident about medical responses in the event of a burns disaster.^{36,37,38,39} Our previous survey also indicated limitations, with an overall rate of sufficient knowledge of 39.7% correct answers for nurses and 45.4% for physicians.^{15,16} The same situation was reported by Kut et al..⁴⁰ In 2007, Wetta-Hall et al. conducted a continuing education program on management of multiple burn incidents for healthcare practitioners. The percentage of correct responses increased from 30% to 65%. In addition, 64% of participants felt they were able to manage multiple burn casualties after the training program.^{41,42} Based on the surveyed demand, in 2015 McWilliam et al. conducted a training program on

burn emergency management using video conference with positive outcomes.³⁹ Kua Phek Hui et al (2016) conducted an emergency burns management training course for 274 healthcare providers at a paediatric trauma centre in Singapore using the European guidelines. The post-test results indicated a significant improvement in knowledge.⁴³ Our post-training results also demonstrated an improvement in the knowledge, practical skills and self-confidence of participants regarding the management of mass burns injuries.

It is also important to note that the training program should be repeated to maintain perception and practical skills.^{29,44} Schenker and colleagues, in 2006, evaluated results of victim triage using the

START protocol at a fire simulation scene with 130 victims. All the participants had been trained in the past but training had not been repeated before the drill. The rate of correct triage was only 78%, and this fell further to 62% when the status of victims changed during the triage process.⁴⁵

Conclusion

Our results showed that conducting training courses that combine theory with practical simulations leads to a significant improvement in the capabilities and competence of medical staff regarding the emergency management of major burn incidents.

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